

# Annual Report April 2013 - March 2014

## Laboratory Service:

Scottish MRSA Reference Laboratory

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**Date : May 2014**

## 1. Summary with key points for consideration:

- Referral numbers remain below planned levels. SMRSARL has taken on some enterococcal typing in 2014.
- An increasing, but still small, number of referrals are requests for typing of MSSA because of suspected transmission on wards.
- Typing methods are continually reviewed to find the right place in our protocols for the newer methods. A future role for whole genome sequencing has to be considered because of its rapidly decreasing cost.
- All posts are filled at present & with the Director retiring in April 2014, a new Director & Deputy Director have been appointed.
- The Laboratory Manager retires in November 2014.
- Updating of our reporting methods continues with reports now being issued through the New Telepath System.
- The move to new laboratory accommodation caused an extra substantial workload.

## 2. Activity data

**2.1 Contracted activity:** The indicative activity for the service agreement is 8000 isolates. Of these 8000, the indicated breakdown of tests carried out is as follows:

Test	Type	Contracted number	Actual number	Number Positive
Phenotypic	Biochemistry	4750	4024	Not applicable
	Sensitivity	4750	4024	Not applicable
Genotyping	Spa or PFGE/PCR-R	4750	4024	Not applicable
Toxin Gene detection	Including PVL	5100	3918	893
Other gene PCR	Including mecA gene	4750	4024	Not applicable
Miscellaneous Tests	Including veterinary isolates and CNS	250	106	Not applicable
<b>TOTAL</b>		<b>24350</b>	<b>20120</b>	

The actual activity is higher than last year but is lower than the contracted level. The number of blood culture isolates increased from last year. As a guide to the decrease in MRSA infections, 20% of 1721 blood culture isolates received in 2010/11 were MRSAs, 13% of 1556 in 2011/12, 12% of 1520 in 2012/13, and 11% of 1588 in 2013/14. These figures reflect the increase of MSSA blood cultures. The change could be different for non-bacteraemic infections. Genotyping: 97 isolates were PCR-Ribotyped, 3918 isolates were spa typed and 123 were typed by PFGE. There

has been a continued significant, though fairly small, increase in the number of isolates of staphylococci (including coagulase negative species) referred for testing of susceptibility to glycopeptides, daptomycin and linezolid. SMRSARL is in the process of typing strains of enterococci and determining resistance to glycopeptides.

<b>Test / Investigation:</b>	<i>Phenotypic and Genotypic (MRSA &amp; MSSA)</i>	
	<b>Current Year</b>	<b>Previous Year</b>
<b>Health Board</b>		
<b>A &amp; Arran</b>	171	211
<b>Borders</b>	83	74
<b>D&amp;G</b>	97	70
<b>Fife</b>	202	207
<b>Forth Valley</b>	139	115
<b>GG&amp;C</b>	875	881
<b>Grampian</b>	470	553
<b>Highland</b>	186	212
<b>Lanarkshire</b>	615	509
<b>Lothian</b>	490	600
<b>NWTC</b>	186	136
<b>Tayside</b>	384	404
<b>W. Isles</b>	14	23
<b>Orkney</b>	6	6
<b>Total</b>	<b>3918</b>	<b>4001</b>

The basic set of phenotypic and genotypic tests are performed on all MSSA and MRSA isolates received.

<b>Test / Investigation:</b>	<i>Toxin Gene PCR</i>	
	<b>Current Year</b>	<b>Previous Year</b>
<b>Health Board</b>		
<b>A &amp; Arran</b>	171	206
<b>Borders</b>	83	72
<b>D&amp;G</b>	97	61
<b>Fife</b>	202	200
<b>Forth Valley</b>	139	110
<b>GG&amp;C</b>	875	742
<b>Grampian</b>	470	440
<b>Highland</b>	186	164
<b>Lanarkshire</b>	615	404
<b>Lothian</b>	490	538
<b>NWTC</b>	186	85
<b>Tayside</b>	384	366
<b>W. Isles</b>	14	23
<b>Orkney</b>	6	4
<b>Total</b>	<b>3918</b>	<b>3415</b>

Many toxin detection PCRs are carried out as a result of requests by users. PVL toxin testing is carried out on all MRSA and MSSA isolates submitted.

<b>Test / Investigation:</b>	<i>Other Gene PCR</i>	
<b>Health Board</b>	<b><i>Current Year</i></b>	<b><i>Previous Year</i></b>
<b>A &amp; Arran</b>	171	203
<b>Borders</b>	83	67
<b>D&amp;G</b>	97	67
<b>Fife</b>	202	204
<b>Forth Valley</b>	139	111
<b>GG&amp;C</b>	875	808
<b>Grampian</b>	470	492
<b>Highland</b>	186	174
<b>Lanarkshire</b>	615	427
<b>Lothian</b>	490	539
<b>NWTC</b>	186	101
<b>Tayside</b>	384	356
<b>W. Isles</b>	14	23
<b>Orkney</b>	6	5
<b>Total</b>	<b>3918</b>	<b>3577</b>

PCRs carried out in this “other” category include: *mecA*, *nuc* and *mupA* gene detection; SCC*mec* typing; aminoglycoside resistance gene identification and *vanA* and *vanB* detection. Each isolate is only counted once in this table. *mecA*, *nuc* and *mupA* gene detection is carried out on all staphylococcal isolates submitted.

<b>Test / Investigation:</b>	<i>Miscellaneous</i>	
<b>Health Board</b>	<b><i>Current Year</i></b>	<b><i>Previous Year</i></b>
<b>A &amp; Arran</b>	7	9
<b>Borders</b>	0	1
<b>D&amp;G</b>	1	1
<b>Fife</b>	1	5
<b>Forth Valley</b>	1	0
<b>GG&amp;C</b>	38	32
<b>Grampian</b>	4	25
<b>Highland</b>	0	3
<b>Lanarkshire</b>	4	17
<b>Lothian</b>	15	17
<b>NWTC</b>	1	4
<b>Tayside</b>	34	33
<b>W. Isles</b>	0	0
<b>Orkney</b>	0	0
<b>Total</b>	<b>106</b>	<b>147</b>

The isolates represented in this section are mainly coagulase negative staphylococci sent for identification, typing and susceptibility testing but 41 veterinary isolates are included. The Veterinary isolates are usually received directly from Veterinary Laboratories, not from the Diagnostic Laboratories in the same Health Board. There is increasing concern about transmission to humans of staphylococci from animal-associated lineages.

## 2.2 Health Impact Activity

<b>Health Board</b>	<b>Organism</b>	<b>Activity</b>	<b>Reason /Outcome</b>
All Boards	MRSA & MSSA blood culture isolates	Surveillance	Participation in EARSS-Net which is a European wide network of national surveillance systems, providing European reference data on antimicrobial resistance for public health purposes.
All Boards	All isolates submitted to the Reference Laboratory	Testing for PVL toxin.	Surveillance, recognition, investigation and management of PVL-S. aureus in Scotland. Recommendations produced by the PVL Development Group for the Scottish Health Protection Network Steering Group.
All boards	All isolates submitted to the Reference Laboratory	Surveillance, analysis and identification of trends	Data submitted to HPS and published in the Quarterly report on the surveillance of Staphylococcal aureus bacteraemias in Scotland.
All Boards	MRSA & MSSA blood culture isolates	Infection Prevention and Control	As part of the Staphylococcus aureus Bacteraemia (SAB) action plan, a SAB checklist has been developed at the request of the Scottish Government Health and Social Care Directorates to support the delivery of SAB HEAT target
All boards	MRSA & MSSA blood culture isolates	Surveillance	Data published by HPS on the

			Healthcare Associated Infections (HAI) rates in Scotland in the HAI Annual Report and as part of the National Infection Prevention and Control Manual.
GG& C	MSSA	Surveillance & additional Typing - PFGE	Surveillance in neonatal unit.
NWTC	MSSA	Surveillance	Ongoing Surveillance of post operative infections.
Veterinary Schools	MRSA	Surveillance	Antimicrobial resistance transfer from companion animals to humans

### 3. Quality assurance report

#### 3.1 Turn around times

Test/Investigation	Mean turnaround time (mode)	Range	% meeting target (target turn around)
All tests	4.47 days (4)	3 to 12 days*	91% (6 days) <sup>‡</sup> 95% (7 days)

Verbal telephone reports are issued on urgently requested tests within 3 days of receipt.

For most isolates received, a single printed report with results for all requested tests is issued. The turnaround time recorded is for this printed report.

<sup>‡</sup>There is a discrepancy between the service level agreement and user manual as to contracted turn around times. This needs to be clarified therefore both figures are given here.

#### 3.2 Internal audit

##### a) Horizontal audits.

A schedule of audits designed to meet CPA requirements is being undertaken. Four audits (Internal Audits of Quality Management System (CPA) A, B, C & D Standards) were carried out during the current year, with no non-conformances.

##### b) Vertical audits.

One vertical audit was completed during this period, with no non-conformances.

**c) Other (give details of type).**

Internal QC system - 38 randomly selected isolates were re-tested for routine phenotypic and genotypic tests (some were sent as duplicates). No major differences were observed. No error logs were required.

The following audits were also carried out:  
A managerial self audit.

Four quarterly Health & Safety workplace inspection audits.

Annual audit of European Working Time Directive.

Twelve Fire and twelve Clinical Waste audits. Any causes for concern have been resolved.

Annual audit of lone working procedures.

Two audits of Health & Safety Management Manual.

Twelve manager's monthly audit of turnaround times.

One UKAS format audit (SMRSARL day-to-day working procedures).

CPA limited re-assessment visit 12 December 2013.

**3.3 Accreditation schemes**

<b>Name of scheme</b>	<b>Current status</b> (e.g. full accreditation)	<b>Date of last visit</b> <b>and type</b>	<b>Date of next visit</b> <b>and type</b>
CPA Scheme	Full Accreditation	12/12/2013 Re-assessment visit	Full Visit/2014

Full CPA Accreditation was granted in October 2010.

**3.4 External audit schemes**

A Scottish Diagnostic Laboratory (Glasgow Royal Infirmary) sent us 3 duplicate specimens as a crude form of EQC. No anomalies were found.

**3.4 Incidents and complaints**

No incidents occurred during this period.

No complaints were received during this period.

**3.5 Equality and diversity impact assessments**

All staff have attended an Equality & Diversity awareness course as part of the Core Statutory and Mandatory Training Programme.

## 4. New developments

Spa typing is now being carried out routinely on all isolates submitted to SMRSARL. Despite a short hiatus following the move to GRI, the technical problems referred to in the 2011/12 report have been resolved and all spa-typing is still being carried out 'in-house'. Spa typing is now being performed in "real time" therefore turnaround times remain within the targets agreed, some years ago, with HPS.

### Service Development Projects

Following on from the migration of services to the New Lister Building at GRI, the introduction of a new computerised reporting system has now been rolled out. Substantial changes have been made to the way reports are issued and how the data is downloaded into databases. This has been a significant undertaking for the laboratory and has not been without challenges. It is now integrated into the daily routine of the laboratory and it is continuing to prove demanding. It is a credit to the staff that turnaround times for the initial month were not impacted.

Multi-locus sequence typing (MLST) has been developed and is now a robust assay within the laboratory. MLST is being used to type isolates that fail spa typing twice, or on outbreak isolates that are not spa typable and have indistinguishable PFGE patterns.

Typing of enterococcal isolates is now being undertaken at SMRSARL. A short 3-month study was performed during which time all diagnostic laboratories were requested to submit *Enterococcus faecium* and *E. faecalis* isolates from bacteraemias. Sensitivities for all isolates were recorded and if vancomycin resistance detected, the isolate then investigated for the presence of *vanA* or *vanB* genes. A new pulsed-field gel electrophoresis assay has been developed for enterococci and plans for a BioNumerics database of these is in place. Results are still being collected on the bacteraemia isolates, however the service will continue to exist for suspected outbreak investigation under agreement with the relevant NHS board infection control teams, HPS and the laboratory. These will be processed and reported in real time and added to the Contracted activity Table in this report as part of Miscellaneous Tests.

## 5. Future developments

The long planned move to refurbished laboratory accommodation at Glasgow Royal Infirmary occurred in November 2013. The extra work generated was considerable and many future development plans have been put on hold.

Developments in *S. aureus* typing methods include widespread European use of spa-typing for surveillance purposes, and limited use of Multilocus VNTR analysis. One of the most exciting developments and one for the not-too-distant future is that of the use of next generation sequencing within clinical and public health microbiology. Advances are being made in this field for the reference laboratory and projects utilising these methods are in the early stages.

For some years we have been supplementing our paper reports (on which we assess turnaround times), with electronic reports (Excel Spreadsheets) - sent to users who can use them to build up a database of their results. Unfortunately we are currently unable to integrate this with the new reporting system. Users have been advised that presently they will no longer be receiving this information. The Reference Laboratories as a whole would wish to progress electronic reporting from the main database as soon as is practicable.

## 6. Teaching

### a) Internal staff training

Type of training –Topics included in the one day Core Statutory & Mandatory Training Programme	Numbers attending
Adult Support and Protection	7 (valid until June 2015)
Child Protection	7 (valid until June 2015)
Conflict Management	7 (valid until June 2015)
Control of Infection	7 (valid until June 2015)
Equality and Diversity	7 (valid until June 2015)
Fire Safety	7 (valid until June 2015)
Health and Safety Awareness (including reporting and risk assessment)	
Moving and Handling Theory	7 (valid until June 2015)
On line GGC Fire Safety Training	7

### b) Individual placements

Visitor	Grade	Speciality	Base place of work	Duration of placement
Beth White	ID Physician	Clinical Microbiology	Brownlee/GRI	1 Day
Sarah Rankin	BSc Co terminus Student		Caledonian University	2 Weeks

### c) External training

*E.g. lectures, tutorials off site, open day etc.*

Type of training	Topic	Numbers attending
First Aid at Work – HSE Approved	2 day Refresher Course to demonstrate competency. (31/07/2012 & 07/08/2012)	1
Train the Trainer	2 day course for Trainers of Co- terminus BSc students.	1
BSAC Educational Workshop	Bone and Joint Infections	1
Molecular microbiology	Rapid NGS for clinical and public health microbiology	1

### d) Meetings Attended

StaphGBI, Dublin Ireland (5-6/09/2013 – 1 staff member).



European Staphylococcus Reference Laboratory Workshop, Groningen The Netherlands (12-13/12/2013 – 2 staff members).

Rapid NGS for Clinical and Public Health Microbiology, Munich Germany (12-14/03/2014 – 1 staff member).

West of Scotland Microbiology Discussion Group – Various.

Monthly journal clubs were attended by all available staff.

## 7. Research

### 7a. Research Projects & Collaborations

A joint grant application with The University of Edinburgh/Roslin Institute to CSO was successful, and £250,000 was awarded for a 3 year study in 2009 - **Development of a novel high-resolution genotyping method (namely Single Nucleotide Polymorphism analysis) for epidemiological and evolutionary analysis for the major Scottish and UK lineages of MRSA** – this project has continued throughout this year. Detecting additional SNPs and modifying the assay to differentiate EMRSA-15 isolates from various outbreaks has been the recent focus. This project has been completed and published. A follow up proposal is in preparation. On-going.

**Community MRSA** (CSO grant application) – Contact with the Scottish Health Survey has been made, and positive feedback was obtained with regards continuing our application to CSO. Funding for a further 4 years has been granted (2012 to 2015). CSO were contacted, but since >3 has lapsed since our last application, a new application is required. On-going.

Cheryl Gibbons (University of Edinburgh) is collaborating closely with SMRSARL to carry out her PhD - **Molecular epidemiology of MRSA in Scotland, 1996-2011** - looking at spatial, temporal and demographic variation of genotypic and phenotypic traits within Scottish MRSA stains, and also looking for the emergence of CA-MRSA-like strains in Scotland. The SMRSARL archive database is proving a valuable source of information for her study. On-going

Kathleen Ruddy (Cranfield University) is collaborating closely with SMRSARL to carry out her MSc, looking at **antibiotic resistance patterns associated with different strains of MRSA over a 15 year period**. This is a long-distance project, using the SMRSARL archive database. For these projects a version of the database without identifiable patient information has been developed and its use agreed by the GG&C Caldecott Guardian. On-going

A collaboration between SMRSARL, HPS and Glasgow Caledonian University has been set up to investigate various aspects of **mupirocin usage and resistance**. A grant application is in the early stages of being drafted. Still under consideration. On-going.

A link with Strathclyde University has been established where the laboratory helped with antibiogram testing of 40 *Staphylococcus aureus* isolates from Saudi Arabia. The laboratory was also able to provide a protocol for testing chlorhexidine resistance within these isolates.

An observational study of the **prevalence of Panton Valentine Leukocidin toxin gene positivity in *S. aureus* samples from different patient populations, including a renal dialysis unit in Glasgow**, was carried out by a Research Fellow in Renal Medicine. This has now been accepted for fulfilment of the requirements for an MD and publication of results is likely.

**EARS-Net/SeqNet.org Spa typing initiative** – continuation of surveillance of MRSA clones in Europe.

## 7b Publications & Presentations

### A. Publications

Novel mutations in penicillin-binding protein genes in clinical *Staphylococcus aureus* isolates that are methicillin resistant on susceptibility testing, but lack the *mec* gene.

Ba X, Harrison EM, **Edwards GF**, Holden MT, Larsen AR, Petersen A, Skov RL, Peacock SJ, Parkhill J, Paterson GK, Holmes MA. *J Antimicrob Chemother.* 2014 Mar;69(3):594-7. doi: 10.1093/jac/dkt418. Epub 2013 Nov 11.

Phenotypic detection of *mecC*-MRSA: cefoxitin is more reliable than oxacillin.

Skov R, Larsen AR, Kearns A, Holmes M, Teale C, **Edwards G**, Hill R. *J Antimicrob Chemother.* 2014 Jan;69(1):133-5. doi: 10.1093/jac/dkt341. Epub 2013 Sep 12

Genome-wide single nucleotide polymorphism-based assay for high-resolution epidemiological analysis of the methicillin-resistant *Staphylococcus aureus* hospital clone EMRSA-15. Holmes A, McAllister G, McAdam PR, Hsien Choi S, **Girvan K, Robb A, Edwards G**, Templeton K, Fitzgerald JR. *Clin Microbiol Infect.* 2014 Feb;20(2):O124-31. doi: 10.1111/1469-0691.12328. Epub 2013 Aug

Use of Vitek 2 antimicrobial susceptibility profile to identify *mecC* in methicillin-resistant *Staphylococcus aureus*.

Cartwright EJ, Paterson GK, Raven KE, Harrison EM, Gouliouris T, Kearns A, Pichon B, **Edwards G**, Skov RL, Larsen AR, Holmes MA, Parkhill J, Peacock SJ, Török ME. *J Clin Microbiol.* 2013 Aug;51(8):2732-4. doi: 10.1128/JCM.00847-13. Epub 2013 May 29.

Staphylococcal dermatitis/pododermatitis and septicaemia in neonatal puppies.

Philbey AW, Taylor DJ, **Robb A**, Gibbons JF, Irvine RM, Thompson H. *Vet Rec.* 2013 Nov 2;173(17):424. doi: 10.1136/vr.101832. Epub 2013 Oct 3.

Antibiotic susceptibility and resistance of *Staphylococcus aureus* isolated from fresh porcine skin xenografts: risk to recipients with thermal injury. Busby SA, **Robb A**, Lang S, Takeuchi Y, Vesely P, Scobie L, Burns. 2014 Mar;40(2):288-94. doi: 10.1016/j.burns.2013.06.006. Epub 2013 Jul 10.

Screening for methicillin resistant *Staphylococcus aureus* (MRSA): who, when, and how?

**Coia JE**, Leanord AT, Reilly J. *BMJ.* 2014 Feb 27;348:g1697. doi: 10.1136/bmj.g1697

Economic evaluation of treatment for MRSA complicated skin and soft tissue infections in Glasgow hospitals.

Seaton RA, Johal S, **Coia JE**, Reid N, Cooper S, Jones BL. *Eur J Clin Microbiol Infect Dis.* 2014 Mar;33(3):305-11. doi: 10.1007/s10096-013-1956-z. Epub 2013 Aug 31.

### B. Presentations/Posters

**Elizabeth Dickson, Giles Edwards, Andrew Robb, Kirsty Girvan, Loraine Graham & Bonnie Cosgrove.** CC398 *Staphylococcus aureus* isolates from humans in Scotland. Presented as a Poster, P 18 at StaphGBI, Trinity College Dublin, Ireland 5-6 September.

## 8. Staffing

Bonnie Cosgrove (Laboratory Manager) is retiring in November 2014 and forward planning for this is within the whole Reference Laboratory Group.

All posts are currently filled.

Cheryl Johnson (BMS 1) returned from maternity leave in May 2014.

Giles Edwards retired in April 2014. Prof. John Coia was appointed as Director and Dr Nitish Khanna as Deputy Director.

## 9. Financial report

Submitted separately by GG&C Finance to HPS/NSD.

## 10. Summary and conclusions

- Referral numbers increased but remain below planned levels. SMRSARL is processing some enterococcal typing in 2014.
- An increasing, but still small, number of referrals are requests for typing of MSSA because of suspected transmission on wards.
- Typing methods are continually reviewed to find the right place in our protocols for the newer methods. A future role for whole genome sequencing has to be considered because of its rapidly decreasing cost.
- All posts are filled at present & with the Director retiring in April 2014, a new Director & Deputy Director have been appointed.
- The Laboratory Manager retires in November 2014.
- Member of staff on Maternity Leave returned in May 2014.
- Updating of our reporting methods continues with reports now being issued through the New Telepath System.
- The move to new laboratory accommodation caused an extra substantial workload. The department is now housed in Level 5 of the New Lister Building, Glasgow Royal Infirmary and it is anticipated that having routine microbiology and the virus lab on the same site should enhance the scope and development for staff and technology

## 11. Appendices

### Appendix A

#### Vertical Audits carried out:

Nothing to add.

#### Other Audits carried out:

Nothing to add.

#### Internal QC

Nothing to add.

**Appendix B**

Nothing to add

**Appendix C**

Nothing to add.

**Appendix D**

Nothing to add